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DROUGHT TOLERANCE STUDY ON WINTER WHEAT

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Post-anthesis drought and heat stress is frequent in wheat fields in eastern Oregon. Under normal conditions, grain filling is supported by relocation of stored carbohydrates (soluble sugars) and by current photosynthesis. Final kernel weight is an important component of yield, and it depends on the duration and rate of the grain filling phase. The rate of grain filling is dependent upon a continuous supply of carbohydrates to the developing kernel (Evans et al., 1975).

It is well known that the stems of wheat, and other cereals, contain a considerable amount of soluble sugars at anthesis, but at maturity, these substances have virtually disappeared (Stoy, 1965). During grain filling, stems can lose 30 percent or more of their maximum dry weight. It was observed that stem reserves in barley contributed up to 70 percent of kernel weight (Gallagher et al., 1975). Under drought stress, photosynthesis is inhibited and stored reserves become very important in the determination of kernel weight and final yield, since subsequent kernel growth is largely supported by the remobilization of the stored reserves (Austin et al., 1980).

Traditionally, selection of post-anthesis drought tolerant genotypes has required testing of segregating populations under unpredictable stress environments. Blum et al. (1983a), devised a methodology for rapidly and inexpensively selecting stress tolerant genotypes. They reasoned that a chemical desiccation after anthesis would measure the ability of a genotype to support kernel growth in the absence of photosynthesis. They finally concluded that kernel growth was more supported by stored reserves in treated plants than in untreated plants. In a second experiment (Blum et al., 1983b) they concluded that kernel weight injury under chemical desiccation was positively correlated with drought stress injury across cultivars.

This study was initiated under the hypothesis that concentrations of soluble sugars in wheat stems at anthesis play an important role in the ability of the cultivar to tolerate drought stress during grain filling. An experiment was designed to detect and associate changes in soluble sugar concentrations with drought stress tolerance in a set of winter wheat cultivars.

A total of 11 cultivars differing in drought tolerance are being studied in a split plot experimental design located at the Sherman County Branch Experiment Station in Moro. The treatments assigned to main plots are irrigation and no irrigation after anthesis. Cultivars are subplots. From anthesis up to maturity, soluble sugars, leaf water potential, soil water potential, and grain filling parameters will be monitored. Results from this experiment will be used in conjunction with another experiment involving desiccation tolerance, which is located at Hyslop Crop Science Field Research Laboratory in Corvallis.

It is expected that useful information will be obtained on the role that soluble sugars play in drought tolerance. Information will also be obtained on the ability of desiccation tolerance to predict post-anthesis drought tolerant wheat cultivars.

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